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and turned, holding it firmly in his mouth. I saw he was being closely chased by a water-snake who tried to swallow the frog, but the stick in the frog's mouth caught in the jaws of the snake. Several times the snake withdrew, and tried to attack the frog from the rear; but he would jump around, and immediately face the snake again. This happened several times; and at last the snake got tired, and slipped off in the bushes, leaving the frog victorious."

"Pretty good," said Wa-ja-pa. "I'll tell you something. Once late in the fall, Badger and I went hunting along the Loup River. We were afoot. We started up several elk, ran them down, and killed one. While I was butchering, Badger returned to camp for a pony to bring in the meat. After I had skinned the animal, and piled the cuts of meat on the skin, I lay down near by in the tall grass, and fell asleep. I was awakened by the sound of footsteps. Rising cautiously, I saw a large gray wolf standing near the meat. When he espied me, he began to growl, showed his teeth, and all the hair on his back stood up. Taking my gun, I levelled it at him, and shot. He was a fine fellow, and, as he fell, I determined to have his skin at once. It was the work of a few moments to flay him. As I threw his skin to one side, the legs of the wolf began to twitch, and the blood to trickle. In a moment the wolf was on his feet, and walking off without his skin.

"I never have believed in dreams, or the wonderful animals they tell about; but, when I saw that wolf walking away, I felt uncomfortable, but I made up my mind to shoot again. I did so, and he fell, and walked no more."

"When I got there with the pony," put in Badger, "I saw the place where the wolf was skinned, and tracked his steps by his blood to where he lay dead from the second shot."

"I remember hearing," said the young man, "Ou-zu-ga-hae and his brother tell that once, when they were flaying a buffalo-bull they had just shot." Then, turning to me, he said, "You remember, we first cut the skin of a bull down the centre of the back, and take off one-half at a time. Well, when the men had one-half the hide off, up got the buffalo-bull, shaking his head and staggering forward. The frightened brothers ran away as fast as their legs could carry them. The bull went but a little distance, fell, and died. It was some time, however, before the brothers could make up their mind to go back and skin the other side of that animal."

Old Me-pe gave a twitch at my wrap, and said, —

"Can't you tell a story?"

"Yes," I replied, "I will tell you about a black hen I once had. A friend sent me a present of a pair of guinea-fowl. By and by the guinea-hen began to lay; and, as I wanted to be sure to raise some fowl, I put ten of her eggs under a little black hen. She sat patiently for three weeks (the time it takes chickens to hatch), but she had to wait another week for the guinea-chicks. When they came out, — little sleek brown things with yellow legs, — the hen was very happy. But she was soon a troubled hen; for, when she clucked and bustled and scratched for them, they all darted away and hid. In her astonishment, as she stood silently looking for them, they would gradually creep back. Then she would cluck and scratch again, desiring to give them something good to eat; but away would dart the chicks, leaving the hen alone. After several such experiences, the hen evidently thought it was the clucking that scared them: so, as she walked along with her brood, she would scratch, but make no sound. Still, every time she scratched, the chicks shot off and hid. Then she thought a second time, and determined to cluck and call them, but not to scratch. This suited the little guineas, and ever after that the black hen and her ten guineas walked among my flowers and vegetable-garden, doing no damage."

"I have heard white men say hens have no sense," said Wa-ja-pa; "but your hen knew something. Of all the animals, I like the beaver best. He is most like a man. He plans and works and builds."

"You wanted to see an artichoke: there is one," said the young man, tossing the little brown root into my lap. "Yesterday evening I found a field-mouse's nest, and he had stored many artichokes. I went back to-day to get you some; but the mouse had been busy all night, transferring his stores to a secret place. Although I tracked him, it was too bad to rob the little fellow: so I only took one for you." I dropped the root into my purse, where it lies to the present day. A. C. FLETCHER.

#### THE MEXICAN AXOLOTL, AND ITS SUSCEPTIBILITY TO TRANSFORMATIONS.<sup>1</sup>

THE prolonged researches of Miss Marie von Chauvin on the biological relations of the amphibians have led to most interesting results concerning the transformability of the Mexican axolotl. The observations published by this lady ten years ago proved that under certain conditions, and by certain treat-

<sup>1</sup> From the *Journal of science*, June, 1885.

ment, it is possible to convert the aquatic axolotl, breathing by means of gills, into the terrestrial Amblystoma, which breathes by means of lungs. Individual differences, however, came to light which demanded further inquiry. This has accordingly been carried out, and Miss von Chauvin now lays her conclusions before the public in the *Zeitschrift für wissenschaftliche zoologie*.

It was soon found that younger specimens could be more easily transformed than older ones; but even among individuals of the same age great differences came to light, depending upon the manner of treatment. Thus axolotls can be more readily converted into Amblystomas, if they are kept in water containing little air, and are thus compelled to come more frequently to the surface, and to breathe with their lungs. Others, kept in richly aerated water, obtained a sufficiency of air through their gills, and were, in consequence, less readily converted. It appeared, further, that it is merely requisite to apply any external compulsion towards transformation up to a certain grade of development, and that, when this has been reached, the animals arrive at the higher form without any further interference.

The point of time when the axolotl has arrived so far in its metamorphosis as to have totally lost the power of living in water does not coincide with the absorption of the gills. On the contrary, the most recent observations prove that the power of the axolotl to live in water may, under certain circumstances, be retained for a long time in individuals which have become completely adapted to a terrestrial life, and only disappears after the first moulting. Various experiments with axolotls which had passed through this stage proved indubitably that a return to their former life had become impossible: they completed their metamorphosis, even though all possible means were taken for its prevention. On the other hand, axolotls which had lived for months in damp moss, and had breathed with their lungs but had not changed their skins, felt completely at home as soon as they were returned to the water.

This surprising fact induced Miss von Chauvin to institute further experiments on the adaptive power of the axolotl, and in particular to attempt by suitable treatment a repeated transformation of these creatures from the lower to the higher stage, and thence back again to the lower. This interesting experiment has, in fact, been carried out with a successful result.

Without entering upon an account of the means and the precautions used, or a description of the various stages of transformation, we pass at once to the results.

An axolotl lived altogether for three years and a half. The first fifteen months it spent naturally, and without any interference, in the water; its development was then artificially accelerated, and in twelve days it was transformed into a lung-breathing animal; it then lived on the land for fifteen and a half months; it was next, during the lapse of six days, brought back to the water, where it spent three and a half months; in the space of eleven days it was

again so modified that it could once more live on the land, where it remained for rather more than six months, up to its death.

The power of adaptation to a change of medium was so distinctly marked in this animal, and was maintained for such a length of time, that Miss von Chauvin instituted a further experiment with axolotls, with the object of interrupting at pleasure the metamorphosis of these creatures, and suspending it for years, and subsequently testing their adaptability. For this purpose, served five axolotls, each about six and a half months old, in which the development of the lungs was easily so far accelerated that they could live on the land. At this stage the further metamorphosis was suspended by a low temperature, and by being placed during the night in water. Nevertheless, in one specimen there occurred quite unexpectedly, after the lapse of fourteen months and twenty-two days, the first moulting, followed by the further conversion into the Amblystoma form. The four others were kept, however, for three years and two months in the state of suspended metamorphosis. After the expiration of this time, the attempt was made to convert two of them back into axolotls, while two others were to pass on fully into the Amblystoma stage. The result of this experiment was affirmative. The first two specimens reverted to axolotls: of the latter two, one died, while the other became a perfect Amblystoma.

The three experimental subjects, whose metamorphosis was arrested on Nov. 8, 1879, were in good health in October, 1884, in spite of the most arbitrary interference with their natural course of development. The Amblystoma was indeed smaller than those which had been transformed previously; but it was nevertheless very active and greedy, and quite conveyed the impression of a healthy, well-developed animal. In the two axolotls also, the arrest of the metamorphosis remained without injurious consequences. They are well developed, and feel quite at home in their element. They can be distinguished from normal axolotls merely by a somewhat smaller size, and by a less luxuriant development of the external gills.

The results of these experiments show how exceedingly great is the influence of the surrounding medium upon the organism of animals. Of the most important agents, air, water, and heat, the last possesses indubitably the greatest power over the nature of the animal; and next after it comes the character of the medium in which the animal is compelled to live. The external conditions of life can transform the nature of an animal either by a sudden metamorphosis or by protracted action; but, in opposition to all these external agencies, there stands a powerful influence seated within the animal, and acquired by inheritance, which can, indeed, be modified to a certain degree, but never entirely suppressed. This circumstance explains both the many individual fluctuations in the result upon perfectly identical treatment, and the want of success of so many experiments.

Miss von Chauvin points out that the cases of

'neotenis' (persistence of embryonal forms) recently observed among the Urodela find at least a partial explanation in the artificial transformation of the axolotl as here described: for it has been shown that the tendency to continued development can be suppressed by suitable influences; and such influences may make their appearance naturally, and involve a persistence of the larval condition.

The importance of this series of investigations on the primitive transit of the vertebrates from the water to the land has been already pointed out. It must not be forgotten that the remarkable tenacity of life of the amphibians is a capital element, both in such natural transit and in the successful result of the experiments described. With insects the case is very different: their metamorphosis has in certain cases been suspended, both naturally and experimentally; but all attempts which we have made to induce the reversion of an insect to a larval condition have so far miscarried.

#### HAS MAN A TAIL?

HAS man a tail? It is a question under dispute. Anatomists have failed to agree as to what constitutes a true tail. A tail is generally understood to be a distinct posterior prolongation of the body, containing a greater or less number of vertebrae. This at once excludes all the cases of a caudal appendix of a fleshy character, such as are found among the rarer abnormalities of human structure. Where does the tail end in front? The comparative anatomist is obliged to designate all the vertebrae behind the sacrum as caudal; so that we are led to the conclusion that the four or five vertebrae of the human coccyx constitute a true though not a protuberant tail. In the embryo, however, during the second month of gestation, the coccyx does form a distinct conical projection, which properly answers to all the requirements of a true tail; so that there can be no question that man has a genuine though rudimentary tail, — a survival from his simian ancestors.

But as man is descended from long-tailed animals, we ought to find evidence in the human embryo of additional vertebrae. Professor Hermann Fol of Geneva has shown (*Comptes rendus*, 1885) that this is the case. He has found, that, besides the thirty-three or thirty-four vertebrae which persist into adult life, there are other temporary ones. In an embryo five and six-tenths millimetres (about twenty-five days), Fol found only thirty-two vertebrae: Prof. W. His had found thirty-three vertebrae in an embryo a little larger, — seven millimetres. This led Fol to suspect that there might be a still further increase, although in the adult there are only thirty-three or thirty-four vertebrae. He examined two embryos of eight or nine millimetres. One of them was divided into a series of three hundred and twenty sections, and every section was drawn with a camera lucida. Upon counting up the series, it was found that there were thirty-eight vertebrae. Comparison with other embryos satisfied Fol that this condition was perfectly

normal. With the exception of the last two, all the caudal vertebrae had a blastema like their anterior fellows. The last two segments were indicated only by the perfectly distinct muscular segments (myotomes). The extremity of the tail was formed solely by the medullary tube, covered only by the skin. The notochord extended almost to the end. The terminal vertebrae have only an ephemeral existence. In embryos of twelve millimetres (six weeks) the thirty-sixth to thirty-eighth vertebrae have fused into a single mass. In embryos of nineteen millimetres the last five vertebrae have apparently fused to make the permanent thirty-fourth. C. S. M.

#### ETHNOGRAPHY OF ANTARCTIC AMERICA.

No inhabited land is found within the antarctic circle; and the title which the learned 'secretary-general of the ethnographic institution' of France has given to his memoir may therefore seem not strictly warranted. But, in the more general sense in which 'arctic' is applied to climate as synonymous with 'wintry,' the epithet 'antarctic' is sufficiently appropriate to the only region of the southern hemisphere in which the climate is severe enough to exert a controlling effect on the habits and character of the people.

Two years ago a little group of Fuegians, comprising four men, four women, and three children, were brought to Paris, and placed, as so many anthropological exotics, in the 'Garden of acclimation.' There they remained for several weeks, and were visited, of course, by many men of science. M. de Lucy-Fossarieu had already made a study of the tribes and languages of California, and naturally did not neglect the opportunity of examining the natives of this more peculiar and less known region. He saw them frequently, and gained much novel information, which considerably modified the opinions previously entertained respecting this people. He was led to examine the works of earlier observers from the time of Magellan to our own, and to gather from their descriptions, combined with his own observations, a view as complete as can now be attained of the ethnology of the southern extremity of our continent. Such, it appears, was the origin of this memoir, for which students of science are under great obligations to the author. It displays in a marked degree the qualities of clearness of statement, and accuracy of deduction, which distinguish the works of the best French investigators. A summary of its contents, with some additions derived from personal observation of the country and the people, will serve to show the importance of the conclusions which the latest evidence tends to establish.

The Rio Negro, a navigable stream of considerable length, divides Patagonia proper from the territories of the Argentine Republic. From this river to the

*Ethnographie de l'Amérique antarctique: Patagons, Araucaniens, Fuégiens.* Par P. DE LUCY-FOSSARIEU. Paris, 1884. 4°.